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A NEW METHOD TO INCREASE THE POWER FACTOR AND ECONOMY OF ELECTRIC POWER AT OIL FIELDS

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As a result of the existing technology of drilling and exploiting oil wells, and the characteristics of the electrical equipment used at oil fields, the power factor is very low in electrical installations of the oil industry. The natural power factor varies from 0.4 to 0.67. This leads to incomplete utilization of station capacity and, consequently, to excess fuel consumption. Cross sections of power lines must be increased and larger transformers used.

A low power factor also caused greater supplementary losses in electrical networks, e.g., losses when the power factor is 0.7 are 40 percent greater than they are in circuits with a power factor of 0.9. A low power factor entails a considerable voltage drop, which often complicates the operation of installations on remote sections of networks.

Power networks have established penalties for consumers whose power factor is below 0.75. Oil-extraction trusts which obtain electric power from large power systems paid 10.2 million rubles extra for this reason.

Oil-industry enterprises are carrying out work on improving the power factor. However, prior to 1948, problems connected with improving the power factor (better utilization of mechanical and electrical equipment and use of compensating installations) were not fully solved due to failure to utilize special equipment and apparatus fully.

A group of Soviet engineers have worked out, for the first time in the Soviet Union and abroad, a new method of improving the power factor -- synchronization of heavy-duty induction motors according to the "DAG" system with selenium rectifiers ("Synchronization of Induction Motors as a Means of Improving Power Factor," Ugletekhizdat, 1948). Operation of the synchronized selenium units at oil fields and plants has been excellent, and therefore it was decided to introduce them at petroleum enterprises on a wide scale.

Working drawings of the units were produced and series production organized at a Moscow plant of "KIP" (Testing and Measuring Instruments Trust).

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At present, 148 installations are in use and 130 are being constructed. Moreover, another 122 have been designed and sites have been chosen.

The number equipped at the Bakinsk enterprises will be considerably increased before the end of 1949.

The selenium units have functioned satisfactorily in all cases. For example, at enterprises in Groznyy, where there are a number of units in operation, the over-all power factor has been increased from 0.63 to 0.723. It reached 0.74 in September, i.e., it came near the value 0.75 at which surcharges are not made.

As a result, 3,650,000 rubles of surcharges have been eliminated and losses have been cut by 350,000 rubles. The use of these units has not only reduced expenditures on electric power, but has also improved the quality of electric power supplied to consumers. Feeder voltage was increased by 10 percent, which enabled the radius of action of feeders to be increased without the construction of extra substations.

Thus, at a prospecting area two deep drills worked for a prolonged period on a 6-kilovolt line 14.5 kilometers long with a load of 700 kilowatts. This was possible only after selenium units had been installed.

The first lift water-pumping station at one enterprise is fed from a 6-kilovolt line 23 kilometers long with a 400-kilowatt load. Because of the installation of selenium units, normal voltage is maintained at the electric motors. Enterprises of one trust are fed by two 20-kilovolt lines 35 kilometers long. Due to the great drop in voltage, both lines always had to be used formerly, and it was not possible to switch one off for repair without imposing load restrictions. The installation of selenium units for synchronizing the motors made it possible to operate with a single line. Similar results have been attained at all enterprises where the units were installed.

Calculations on the results obtained by the above petroleum enterprises show that in one year a mere 400 units will save about 100 million kilowatt-hours by lowering losses. This corresponds to a saving of 50,000 tons of liquid fuel.

Use of the "DAG" synchronization system solves the problem of improving the power factor and considerably increases the utilization of power produced by electric power stations, substations, and electric networks.

The oil industry's experiment in organizing the production and wide-scale introduction of synchronized selenium units can be recommended for mass introduction in power systems of other branches of the national economy.

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